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## (54) Induction coil with lapped joint.

(57) A single turn induction coil (12) which provides uniform sealing of lids (23) to plastic containers (22). A first end (34a) of the coil overlaps a second end (34b) of the coil with the ends being tapered to form a single complete ring. An electrical current is coupled to the overlapped portions of the first and second end of the coil so the electrical current flows for more than 360° around the coil (12). This provides an induced electrical current around a container lid (23) adjacent to the coil and provides heating of the complete circumference of the lid. A variety of shapes of containers and matching lids can be used with the present invention.

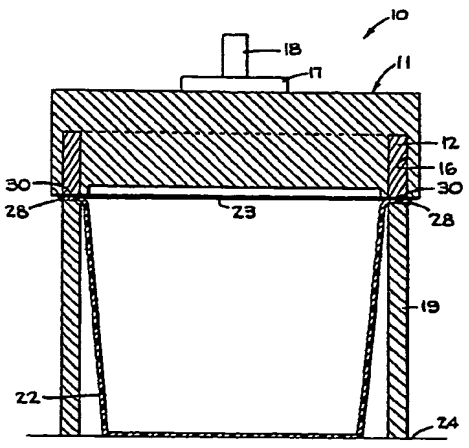


FIG_1

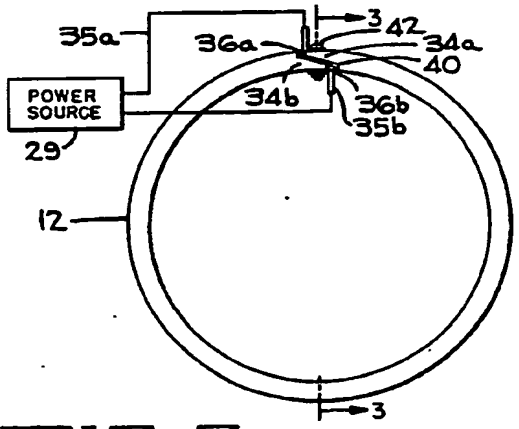


FIG_2



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# INDUCTION COIL WITH LAPPED JOINT

## BACKGROUND OF THE INVENTION

The present invention relates to induction heating coils, and more particularly, to a single turn coil which provides heating for uniform sealing of lids to food containers around a complete circumference of the containers.

Plastic containers are commonly used for the packaging of food and for a wide variety of other items wherein a plastic lid is bonded to the container by the application of heat. One method of bonding involves the use of a laminated plastic lid having a layer of metal foil. A power supply provides an electrical current to a nearby induction coil which induces an electrical current into the metal foil to develop heat which melts portions of the lid and container and fuses the lid to the container. Multiple turn induction coils are rather bulky and difficult to mount in position to press the lid against the container during the sealing operation. Single turn coils are more convenient for pressing against the lid but have a small gap between the ends which causes a poor seal in an adjacent portion of the lid.

## SUMMARY OF THE INVENTION

The present invention discloses an induction heating system using a single turn coil which provides uniform sealing of lids to containers around the complete circumference of the containers. A first end of the coil overlaps a second end of the coil with the ends being tapered to form a single complete ring. An electrical current is coupled from a source of electrical power to an overlapped portion of the first and second coil ends so an electrical current flows for more than 360° around the coil. The coil current induces a current in a container lid adjacent to the coil and heat is developed in the lid from the induced current. Heat is then transferred from the lid to an adjacent flange portion of the container. When a bottom portion of the lid and an upper portion of the container flange reach the melting point, the lid and container fuse together with the help of pressure from the induction coil.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a cross section of an induction heating system with a container and lid using a single turn coil of the present invention.

Figure 2 is a plan view of a single turn coil of the present invention with a source of electrical power attached to the coil.

Figure 3 is a sectional view taking along line 3 - 3 of Figure 2.

Figure 4 is an enlarged cross section of a portion of the ring of Figure 2.

Figures 5 and 6 are alternate embodiments of the single turn coil of Figures 1 3 showing different types of overlapping ends of the coil.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

A container sealing system 10 in which the present invention can be used is shown in Figure 1. System 10 includes a coil assembly 11 having a single turn coil 12 mounted in a groove 16. A plate 17 and a rod 18 attached between assembly 11 and a source of mechanical pressure (not shown) provide vertical movement of assembly 11. A plastic container 22 having a laminated plastic and foil lid 23 is mounted in a base 19 which is supported by a platform 24. In a high production sealing system platform 24 can be a moving conveyor belt which transports containers in a single file into position under coil assembly 11.

When lid 23 is to be sealed to container 22, coil assembly 11 is raised by rod 18 so container 22 and lid 23 can be moved into position (Fig. 1) directly under assembly 11. Assembly 11 is lowered until coil 12 presses lid 23 firmly against an upper lip 28 of container 22. An electrical current from source 29 (Fig. 2) is applied to coil 12 causing an induced current to flow in lid 23. The induced current provides heat which melts a portion of lip 28 and of the adjacent portion of lid 23 to fuse lid 23 to lip 28. The electrical current to coil 12 is terminated and coil 12 briefly remains against lid 23 while lip 28 and lid 23 cool to form a permanent seal. Assembly 11 is then raised so container 22 can be removed and another container and lid moved into position for sealing. Single turn coil 12 includes a smooth lower edge 30 (Figs. 1, 3) which presses lid 23 securely against container lip 28 along the full circumference of lip 28 to provide uniform sealing of lid 23 to container 22.

Coil 12 includes a pair of tapered overlapping ends 34a, 34b (Figs. 2, 4) with a first power output lead 35a from power source 29 connected to an extreme end portion 36a, and a second power

output lead 35b connected to an extreme end portion 36b. Electrical current from output lead 35a flows more than 360° through coil 12 to output lead 35b. Tapered end 34a overlaps tapered end 35b by several degrees, even though the thickness of ring 12 remains constant. The overlapped ends insure that an electrical current in the ring 12 induces a current in lid 23 which heats lid 23 (Fig. 1) and the upper lip 28 to insure a complete seal between the container and the lid. An insulator 40 is mounted between a tapered surface 41a of end 34a and a matching tapered surface 41b of end 34b. A bolt 42 and an insulating sleeve 46 are mounted in a hole 47 to secure surfaces 41a, 41b against insulator 40. When nut 48 and bolt 42 are formed from an insulating material, sleeve 46 can be omitted from the apparatus.

Figure 5 discloses another embodiment of a single turn coil 12a with a slightly different shape of tapered ends 34c, 34d and of insulator 40c. Bolt 42 and nut 48 can be made of an insulating material or an insulating sleeve 46 can be used as shown in Figure 4.

Figure 6 discloses a third embodiment of a single turn coil 12d with another shape of ends 34e, 34f and of insulator 40e.

A single turn coil of the present invention has overlapping ends with electrical power applied to end portions so an electrical current flows for more than 360° around the coil to provide uniform heating of a container and container lid adjacent to the coil.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention.

## Claims

1. An induction heating system for providing uniform heat around a complete circumference of plastic food containers to provide uniform sealing of lids to the food containers wherein said lids have a layer of metallic material, said system comprising:
a single turn electrical coil having a first end and a second end with said first end overlapping said second end to extend said coil over at least 360° of a container circumference;
a source of electrical power for selectively supplying an electrical current to first and second output leads;
means for connecting said first output lead of said source to said first end of said single turn coil;
means for connecting said second output lead of said source to said second end of said single turn coil; and
means for positioning said coil adjacent to a lid mounted on a container to induce an electrical current in said layer of metallic material to develop heat for sealing said lid to said container in response to an electrical current in said coil.

2. An induction heating system as defined in claim 1 wherein said overlapping first and second ends of said coil are tapered to form a single complete ring with a portion of said first end overlapping a portion of said second end.

3. An induction heating system as defined in claim 2 including insulating means mounted between said tapered portions of said first and said second ends of said coil.

4. An induction heating system as defined in claim 2 including means for connecting said first output lead to an extreme end portion of said first coil end, and means for connecting said second output lead to an extreme end portion of said second coil end to cause an electrical current from said electrical source to flow through said coil for more than 360° around the circumference of a container being sealed.

5. An induction heating system as defined in claim 2 wherein said ring is a truncated cylinder.

6. An induction heating system as defined in claim 2 wherein said ring includes a smooth edge and means for pressing said smooth edge against said lid to uniformly secure said lid against said container.

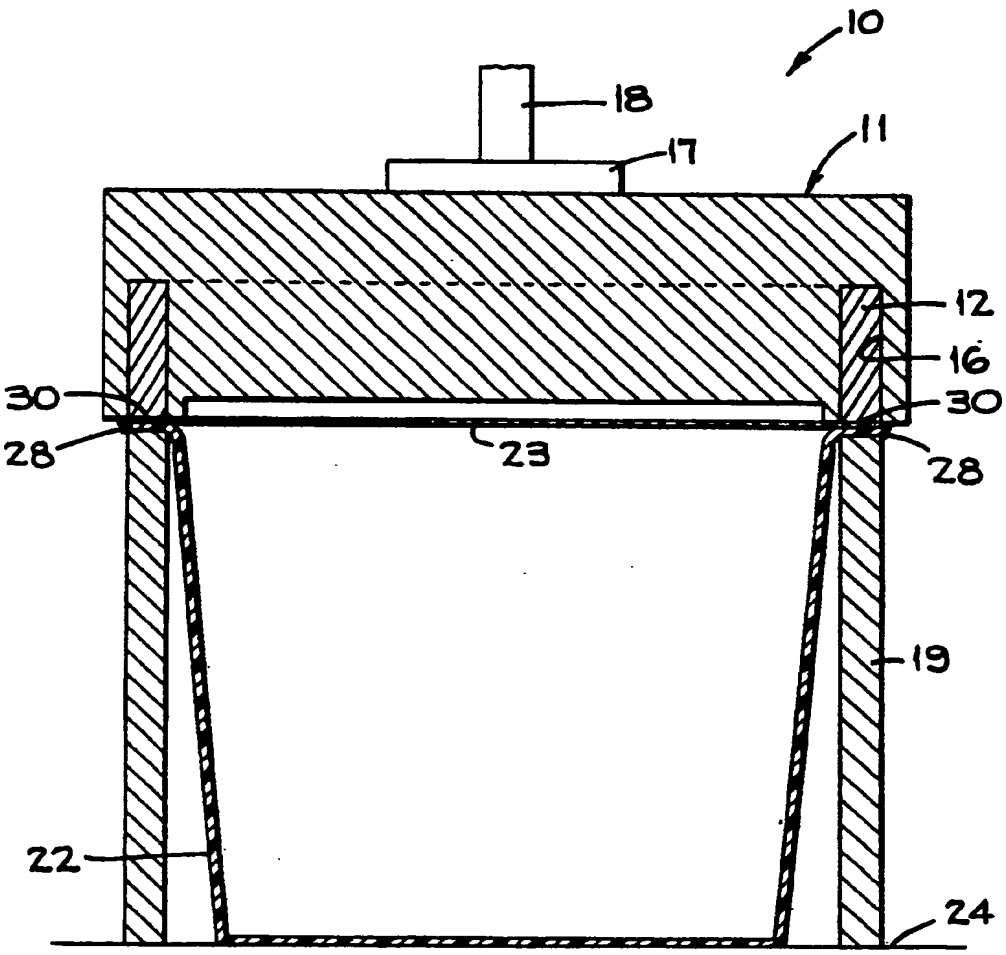


FIG_1

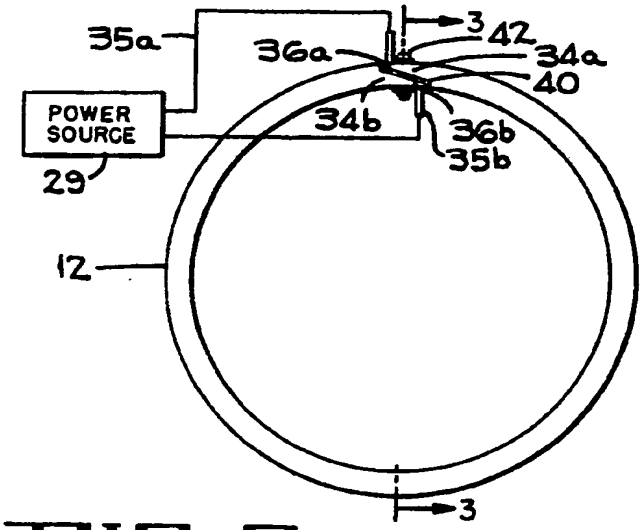


FIG_2

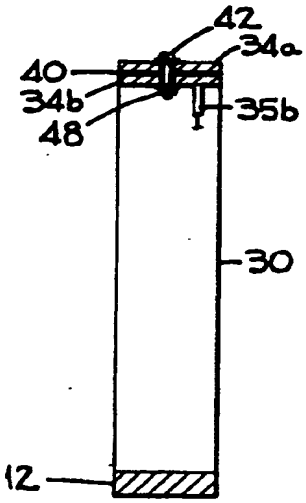


FIG_3

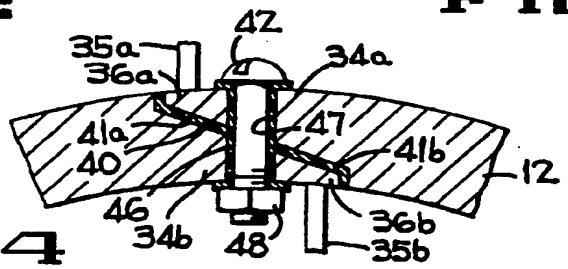


FIG_4

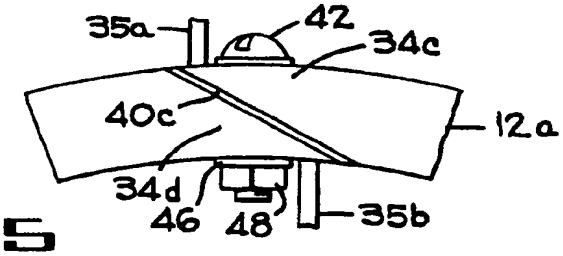


FIG_5

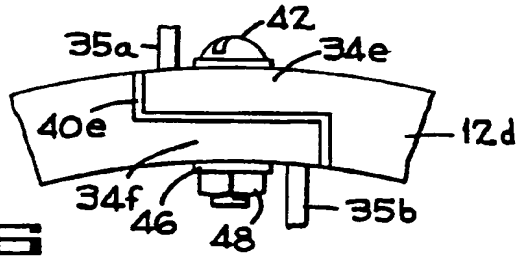


FIG_6

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# EUROPEAN SEARCH REPORT

Application Number

EP 90 12 0699

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
|---|---|---|---|
| Y | DE-A-3 603 766 (WACKER-CHEMITRONIC)<br>* Column 3, line 63 - column 4, line 45; figures 2,3B * | 1-5 | B 65<br>B 51/22<br>H 05 B 6/36 |
| Y | US-A-3 367 808 (B. EDWARDS)<br>* Column 3, line 6 - column 4, line 14; figures 1-6 * | 1-5 | |
| A | US-A-2 408 229 (W. ROBERDS)<br>* Column 3, line 5 - column 4, line 46; fig. * | 1-5 | |
| A | EP-A-0 288 880 (SHIN-ETSU HANDOTAI)<br>* Column 8, line 46 - column 10, line 35; figures 1,2 * | 1,2,4,5 | |

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 65 B
H 05 B
B 29 C

The present search report has been drawn up for all claims

| Place of search | Date of completion of search | Examiner |
|---|---|---|
| The Hague | 22 January 91 | JAGUSIAK A.H.G. |

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